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The occurrence of *Fritziana* Mello-Leitão, 1937 (Anura, Hemiphractidae) in Minas Gerais state, southeastern Brazil: new records and distribution of the genus

Marco Antônio Amorim Peixoto[1, 2*], **Carla Silva Guimarães**[1], **Douglas Henrique da Silva**[1] and **Renato Neves Feio**[1]

1 Museu de Zoologia João Moojen – MZUFV, Departamento de Biologia Animal, Universidade Federal de Viçosa, CEP 36570-900, Viçosa, MG, Brazil

2 Laboratório de Sistemática Molecular – Beagle, Departamento de Biologia Animal, Universidade Federal de Viçosa, CEP 36570-000, Viçosa, MG, Brazil

* Corresponding author. E-mail: marco.peixotom@gmail.com

Abstract: *Fritziana* is currently composed by four species known from mountain regions in the Brazilian states of Espírito Santo, Paraná, Rio de Janeiro, Rio Grande do Sul, Santa Catarina, and São Paulo. Based on field records, literature, and data gathered from collections, we present new records and a distribution map for the species of the genus. *Fritziana* is now recorded for seven Brazilian states, including five localities in Minas Gerais. We also confirm *Fritziana goeldii* (Boulenger 1895) in the same state. The genus distribution now ranges in the southern Espinhaço mountain range, extending in 215 km from the previously known locality.

Key words: amphibia; bromeliads; Espinhaço mountain range; Mantiqueira mountain range; dermal folds

The species of the genus *Fritziana* Mello-Leitão, 1937 are commonly known as marsupial frogs due to their reproductive habits in which females carry their eggs on their backs, between dermal folds, which can form a closed pouch or an open basin. Subsequently, the female releases the tadpoles in water accumulated inside bromeliads or bamboos (Duellman and Gray 1983; Weygoldt and Carvalho-e-Silva 1991; Haddad and Prado 2005; Duellman et al. 2011). Currently, four species are recognized in the genus: *F. fissilis* (Miranda-Ribeiro, 1920), *F. goeldii* (Boulenger, 1895), *F. ohausi* (Wandolleck, 1907), and the recently revalidated *F. ulei* (Miranda-Ribeiro, 1926). However, the diversity within *Fritziana* is considered underestimated and potential species has been raised in recent reviews (Schmid et al. 2013; Castroviejo-Fisher et al. 2015).

These species are associated with mountain regions and adjacent coastal areas in the states of Espírito Santo, Paraná, Rio de Janeiro, Rio Grande do Sul, São Paulo, and Santa Catarina (Duellman et al. 2011; Folly et al. 2014; Frost 2014; Franz and Mello 2015), in southeastern and southern of Brazil. None of these studies revealed the presence of this genus in the state of Minas Gerais, Brazil. Herein, we report the occurrence of populations of the genus *Fritziana* for the state of Minas Gerais. In addition, we present a distribution map of the genus and discuss its historical distribution in Minas Gerais state.

Specimens of the genus *Fritziana* were captured during field work in Reserva Particular do Patrimônio Natural Santuário do Caraça (20°05′51″ S, 043°29′18″ W; 1,850 m. above sea level [a.s.l.]) (RPPN Santuário do Caraça), municipality of Catas Altas, in November 2009, and in the southern portion of Serra do Brigadeiro (20°53′35″ S, 042°32′48″ W; 1,300 m. a.s.l.), municipality of Rosário da Limeira, between December 2011 and January 2014, both in Minas Gerais state, Brazil. The collected specimens were housed at the herpetological collection of the Museu Nacional do Rio de Janeiro (MNRJ), Rio de Janeiro municipality, Rio de Janeiro and Museu de Zoologia João Moojen (MZUFV), Universidade Federal de Viçosa, Viçosa municipality, Minas Gerais.

In addition, we visited and analyzed specimens from the herpetological collections of MNRJ and Museu de Ciências Naturais of the Pontifícia Universidade Católica de Minas Gerais (MCNAM), Belo Horizonte municipality, Minas Gerais state and gathered data from the SpeciesLink project database (see Appendix 1 and 2).

Additional data were compiled from literature and photographic record provided by the National Museum of Natural History (USMN), Washington, D.C., United States. For any source, we considered all the records

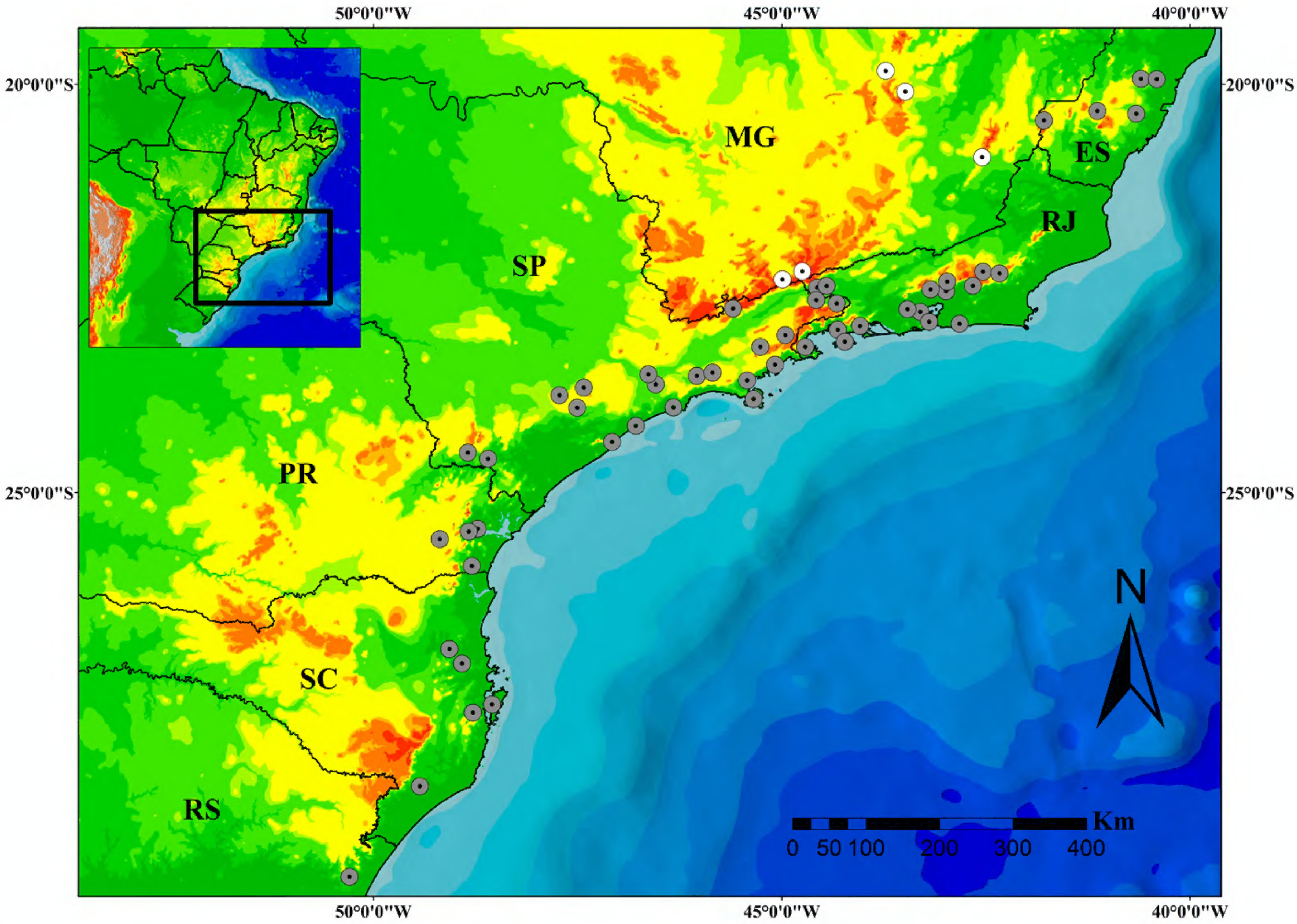

Figure 1. Distribution map of the genus *Fritziana*. Gray circle with a central dot: Records from literature, speciesLink, and collections. White circle with a central dot: records to Minas Gerais state.

that showed the determinations as *Fritziana* and "*Flectonotus*" (including unnamed aff., cf., and sp.) to generate the distribution map of the genus.

We obtained *Fritziana* records for 53 municipalities in seven Brazilian states (Figure 1): Espírito Santo (*n* = 4), Minas Gerais (*n* = 5), Paraná (*n* = 4), Rio de Janeiro (*n* = 14), Rio Grande do Sul (*n* = 1), Santa Catarina (*n* = 5), and São Paulo (*n* = 20). Through field activities in RPPN Santuário do Caraça, Espinhaço mountain range, we collected a single specimen (MNRJ 70360; Figure 2B) in a bromeliad that was in the slope of the valley, near the stream of Pico do Sol, set in an outcrop area. In the southern portion of the Serra do Brigadeiro, Mantiqueira mountain range; six specimens — four males (MZUFV 11720-22 and 11726) and two females (MZUFV 11723 and 15248) — were collected. These specimens were in arboreal bromeliads 1.5–4.0 m above the ground (Figure 2C). In one occasion we observed a male issuing a series of calls (MZUFV 11722).

All aforementioned specimens were identified as belonging to the genus *Fritziana* for presenting the characters corresponding to the diagnosis following Duellman and Gray (1983). Based on the key to species of the genus proposed by Folly et al. (2014), our specimens are related to *F. fissilis*; they present bifid subarticular tubercles on any fingers or toes, which are considered a diagnostic character of *F. fissilis*. However, the dorsal pattern formed by interorbital dark brown hourglass/trapezoid-shaped mark, extending to the sacral region related only to *F. fissilis* (Folly et al. 2014), show variation in the specimens.

We examined three specimens, two males (MCNAM 17658 and 18495) and a female with eggs in the back (MCNAM 17658), from Serra da Piedade, Caeté municipality, that was also identified as belonging to the genus *Fritziana* (Figure 2A). Although presenting bifid subarticular tubercles on any fingers or toes, these specimens also display a dorsal pattern slightly different from that proposed to *F. fissilis* by Folly et al. (2014). In addition, confirmation (by way of a photograph) of the existence of a specimen (USMN 96919) recorded by Cochran (1955) from the municipality of Passa Quatro, Minas Gerais and referred to as *F. goeldii*. The USMN also has another photographic record for the state in the municipality of Itamonte (specimens USMN 232355-56), assigned as *F. ohausi* by the presence of an

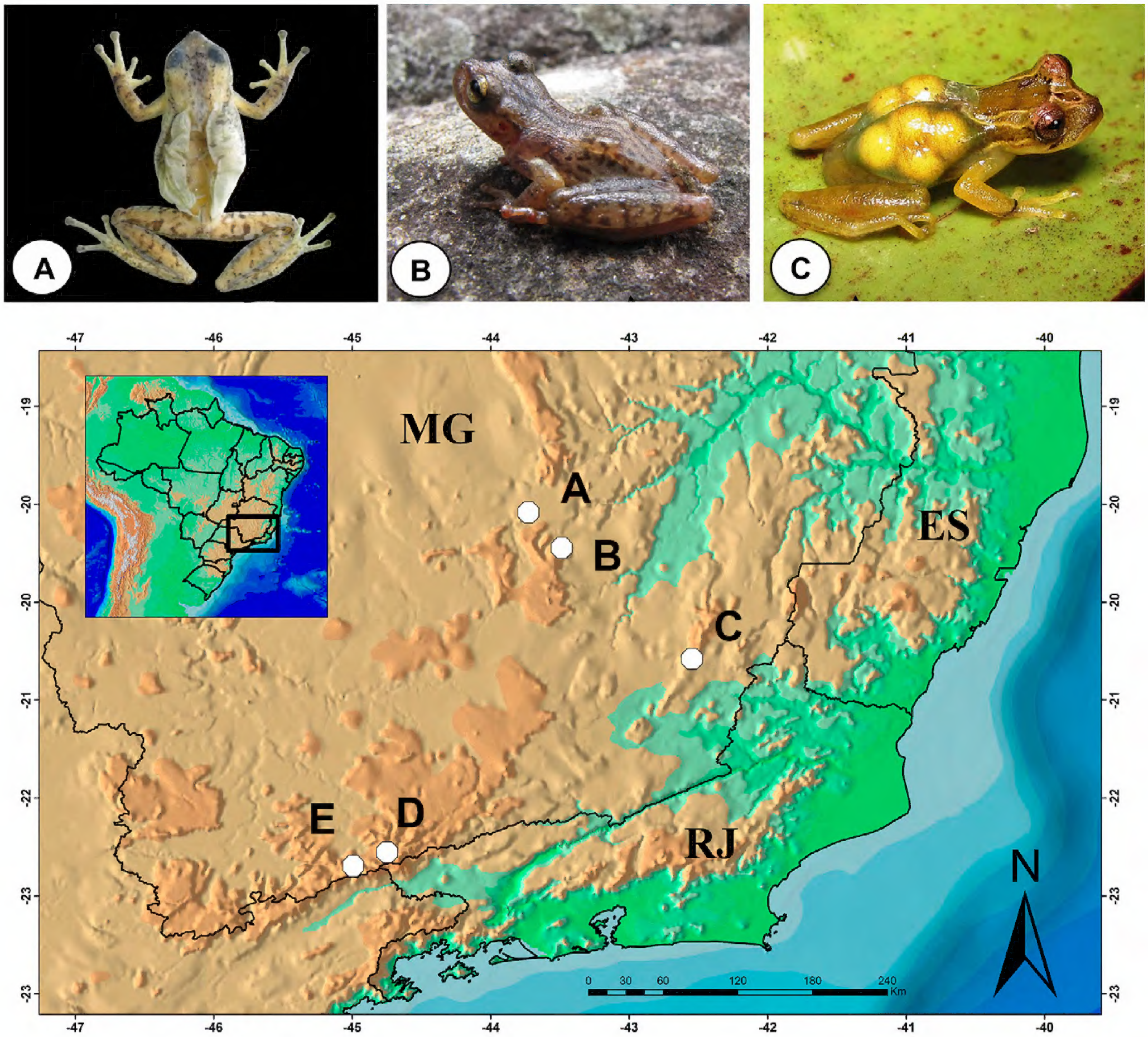

Figure 2. Specimens and records of the genus *Fritziana* in Minas Gerais state. **A**) Caeté, **B**) Catas Altas, **C**) Rosário da Limeira, **D**) Itamonte, **E**) Passa Quatro.

interorbital brown inverted triangle-shaped mark, with two stripes that are long and divergent in this specimen (see Folly et al. 2014).

The occurrence of the genus *Fritziana* in the south of the Espinhaço mountain range, in the Serra da Piedade, the furthest inland record, 215 km east of the Parque Nacional do Caparaó, Ibitirama municipality, Espírito Santo state, the nearest record for the genus.

Originally described for the state of Rio de Janeiro, species of *Fritziana* were always reported as occurring in the hilly regions in the state of Espírito Santo, the Serra do Mar in the state of Rio de Janeiro and also the mountain region in the state of São Paulo (Duellman and Gray 1983; Folly et al. 2014). Prior studies neglected the Cochran's (1955) record of *F. goeldii* from the municipality of Santa Rita de Passa Quatro (currently Passa Quatro municipality), the first record of the genus from Minas Gerais state. In addition to the record from Passa Quatro, four records from the municipalities of Caeté, Catas Altas, Itamonte, and Rosário da Limeira, increase the known distribution of the genus *Fritziana* in the state.

Although the specimens from Serra do Brigadeiro, RPPN Serra do Caraça, and Serra da Piedade are related as *F. fissilis*, we did not assign those as belonging to this species. The characters appointed as synapomorphy to *F. fissilis* do not fit them. It is now recognized that different populations assigned to *F. fissilis* belong to a species complex and, an integrative approach (bioacustic, morphologic, and molecular), is necessary to determine the real identities of these populations (Franz and Mello 2014; Padial et al. 2014; Castroviejo-Fisher et al. 2015).

However, we do not reject the possibility that these populations are undescribed taxon.

Our record from the Serra do Brigadeiro corroborates the observation of the genus in areas within the Atlantic Rainforest biome. Our specimens were found in a fragment composed by semi-deciduous seasonal forest in upper montane (Veloso et al. 1991). These new records from the Serra de Piedade and RPPN Serra do Caraça extend the distribution of the genus to areas transitional between the Atlantic Rainforest and Cerrado biomes. These transition areas are characterized as regions with herbaceous and shrubby vegetation, with the possible presence of underdeveloped trees, typical of grasslands (Ribeiro and Walter 1998).

The new records from mountainous areas of Minas Gerais reinforce the observations made by Leite et al. (2008) who commented that the low richness of amphibians at higher elevations is related to the scarcity of water. However, bromeligenous species such as the *Fritziana* are better adapted to such condition. These records also reinforce the need for more studies in mountainous areas using methodologies that are better suited to locate this genus with such a specialized habitat.

Fritziana proves to be a genus with wide distribution throughout the Atlantic Rainforest of southern and southeastern Brazil, with potential for the discovery of new populations and taxa. However, specimens are deposited in collections and set aside without study, which hampers the conservation of *Fritziana* specimens.

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APPENDICES

Appendix 1. The data provided by the SpeciesLink project database was recovered for the following collections: Museu de Biologia Prof. Mello Leitão (MBML), Santa Teresa municipality, Espírito Santo state; Coleção de Anfíbios do Centro de Coleções Taxonômicas from Universidade Federal de Minas Gerais (UFMG-AMP) and MCNAM-Anfíbios, both in Belo Horizonte municipality, Minas Gerais state; Coleção de Anfíbios do Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul (MCT-PUCRS), Porto Alegre municipality, Rio Grande do Sul state; Coleção de Anfíbios Célio F. B. Haddad, Universidade Estadual Paulista (CFBH), Rio Claro municipality; Sistema de Informação Ambiental do Biota-Fundação de Amparo à Pesquisa do Estado de São Paulo (SINBIOTA); Museu de Zoologia Prof. "Adão José Cardoso" from Universidade Estadual de Campinas (ZUEC-AMP), Campinas municipality; and Coleção de Anfíbios da Universidade Estadual Paulista (DZSJRP), São José do Rio Preto municipality, all in São Paulo state.

Appendix 2. Localities of the genus *Fritziana* used in the map (Figure 1), obtained from collection specimens (consulting SpeciesLink; http://splink.cria.org.br, museums and photograph specimens). The specimens from SpeciesLink were not analyzed by us in order to confirm the identity and therefore this is responsibility of the curators.

Fritziana fissilis — Espírito Santo: Domingos Martins (MBML-ANFIBIOS 7235; UFMG-AMP 14191-95); Santa Teresa (ZUEC-AMP 8900). Paraná: Morretes (DZSJRP-AMPHIBIA-ADULTS 5251). Rio de Janeiro: Itatiaia (MNRJ 48058-60, 48080-85, 48104; UFMG-AMP 13292); Nova Friburgo (UFMG-AMP 14116; MNRJ 62845); Paraty (MNRJ 1301); Resende (MNRJ 83418-19); Rio de Janeiro (MNRJ 48107-09); Teresópolis (MNRJ 48106, 48151-53; ZSJRP-AMPHIBIA-ADULTS 598). Santa Catarina: Brusque (MNRJ 44358); Florianópolis (MCP-ANFIBIOS 8283-4). São Paulo: Apiaí and Iporanga (CFBH 25632-34); Biritiba Mirim (CFBH 12240); Salesópolis (MNRJ 1557-8); Caraguatatuba (CFBH 8273; ZUEC-AMP 3821); Cunha (CFBH 12194); Ilha Bela (CFBH 17496); Iporanga (CFBH 6301, SINBIOTA C10092T86228); Itanhaém (CFBH 8333, 12205, 22113, 22143; SINBIOTA C11010T97612-13; ZSJRP-AMPHIBIA-ADULTS 599, 600); Juréia (MNRJ 46989); Piedade (CFBH 23316); São José do Barreiro (ZUEC-AMP 942-43); São Luís do Paraitinga - SINBIOTA C10335T88177, C10319T87403; São Paulo (CFBH 13572); Itanhaém (CFBH 11177; MNRJ 48089-91, 49558-69); Santo André (CFBH 28980); Ubatuba (CFBH 4542, 19955); Tapiraí (CFBH 10315).

Fritziana goeldii — Espírito Santo: Santa Teresa (MBL-ANFIBIOS 500, 2821-22, 848-51; MNRJ 28540, 56057-62; UFMG-AMP 13743, 13145); Venda Nova do Imigrante (MNRJ 81489). Minas Gerais: Passa Quatro (USMN 96919). Rio de Janeiro: Cachoeiras de Macacu (MNRJ 51516, 67315, 83732); Duque de Caixas (MNRJ 87429, 60552); Itatiaia (MNRJ 48110); Nova Friburgo (MNRJ 48313, UFMG-AMP 14104-05); Nova Iguaçu (MNRJ 77533, 78780); Petrópolis (MNRJ 49320, 83325); Resende (ZUEC-AMP 4088); Rio de Janeiro (ZSJRP-AMPHIBIA-ADULTS 95); São Pedro da Serra (MZUFV 15576-78); Teresópolis (MNRJ 44592, 48179-80, 50450, 68937). São Paulo: Campos do Jordão (CFBH 293-94; SINBIOTA C11030T97665-67; ZUEC-AMP 541-43, 950-51, 1091-92); Salesópolis (ZUEC-AMP 3608); Santo André (CFBH 28980); Ubatuba (CFBH 4542, 9540, 10909-10; ZUEC-AMP 637, 1063).

Fritziana ohausi — Minas Gerais: Itamonte (USMN 232355-56). Rio de Janeiro: Teresópolis (MNRJ 46538-39, 49321, 51323-29, 72153-64; ZUEC-AMP 8105). São Paulo: Apiaí e Iporanga (CFBH 25601); Salesópolis (SINBIOTA C10848T95669); Pilar do Sul (CFBH 7552, 7620; SINBIOTA C10215T86740); Santo André (MNRJ 36653, CFBH 25601, 28974, 28982); Santos (CFBH 15950, 23920); São Luís do Paraitinga (CFBH 7611, 14817-30, 15950, 16276-82, 16545; SINBIOTA C9581T86986, C10216T86753).

***Fritziana* sp.** — Espírito Santo: Espírito Santo: Parque Nacional do Caparaó, Ibitirama (UFMG 17263); Domingos Martins (MNRJ 24960); Fundão (MBML-ANFIBIOS 769-70); Santa Teresa (CFBH 2267; MBML-ANFIBIOS 3859). Minas Gerais: Caeté (MCNAM 17655-59, 18280-81, 18374-74, 18494-95); Catas Altas (MNRJ 70360); Rosário da Limeira (MZUFV 11720-23, 11726, 15248). Paraná: Guaratuba (CFBH 5482). Rio de Janeiro: Nova Friburgo (MNRJ 64646). Santa Catarina: Blumenau (MCP-ANFIBIOS 11919); Florianópolis (MCP-ANFIBIOS 11920-1); Santo Amaro da Imperatriz (CFBH 5726). São Paulo: Pilar do Sul (CFBH 8290, SINBIOTA C10326T87882); Águas de Santa Bárbara (ZUEC-AMP 7187); São José do Barreiro (CFBH 28886, SINBIOTA C10542T89303).

Fritziana* aff. *fissilis — Paraná: São José dos Pinhais (ZSJRP-AMPHIBIA-ADULTS 13461); Santa Catarina: Siderópolis (CFBH 23726, 24277, 25723).

Fritziana* cf. *fissilis — Espírito Santo: Domingos Martins (MZUFV 522-67); Santa Teresa (CFBH 24809-11). São Paulo: Pilar do Sul (CFBH 8614, 9339, 10008; SINBIOTA C10356T88398).

Fritziana* cf. *goeldii — Espírito Santo: Domingos Martins (CFBH 27077-78). Rio de Janeiro: Rio de Janeiro (CFBH 26981).